



SEQUENCE LISTING

<110> Amasino, Richard
Schomburg, Fritz
Michaels, Scott
Sung, Si-Bum

<120> Alteration of Flowering Time in Plants

<130> 960296.96871

<140> 09/513,775

<141> 2000-02-25

<150> 60/121,572

<151> 1999-02-25

<150> 60/123,455

<151> 1999-03-05

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<170> PatentIn Ver. 2.1

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<222> (1)..(588)

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cga caa gtc acc ttc tcc aaa cgt cgc aac ggt ctc atc gag aaa gct 96
Arg Gln Val Thr Phe Ser Lys Arg Arg Asn Gly Leu Ile Glu Lys Ala
20 25 30

cgt cag ctt tct gtt ctc tgt gac gca tcc gtc gct ctt ctc gtc gtc 144
Arg Gln Leu Ser Val Leu Cys Asp Ala Ser Val Ala Leu Leu Val Val
35 40 45

tcc gcc tcc ggc aag ctc tac agc ttc tcc tcc ggc gat aac ctg gtc 192
Ser Ala Ser Gly Lys Leu Tyr Ser Phe Ser Ser Gly Asp Asn Leu Val

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aag atc ctt gat cga tat ggg aaa cag cat gct gat gat ctt aaa gcc			240
Lys Ile Leu Asp Arg Tyr Gly Lys Gln His Ala Asp Asp Leu Lys Ala			
65	70	75	80
ttg gat cat cag tca aaa gct ctg aac tat ggt tca cac tat gag cta			288
Leu Asp His Gln Ser Lys Ala Leu Asn Tyr Gly Ser His Tyr Glu Leu			
	85	90	95
ctt gaa ctt gtg gat agc aag ctt gtg gga tca aat gtc aaa aat gtg			336
Leu Glu Leu Val Asp Ser Lys Leu Val Gly Ser Asn Val Lys Asn Val			
	100	105	110
agt atc gat gct ctt gtt caa ctg gag gaa cac ctt gag act gcc ctc			384
Ser Ile Asp Ala Leu Val Gln Leu Glu Glu His Leu Glu Thr Ala Leu			
	115	120	125
tcc gtg act aga gcc aag aag acc gaa ctc atg ttg aag ctt gtt gag			432
Ser Val Thr Arg Ala Lys Lys Thr Glu Leu Met Leu Lys Leu Val Glu			
	130	135	140
aat ctt aaa gaa aag gag aaa atg ctg aaa gaa gag aac cag gtt ttg			480
Asn Leu Lys Glu Lys Glu Lys Met Leu Lys Glu Glu Asn Gln Val Leu			
145	150	155	160
gct agc cag atg gag aat aat cat cat gtg gga gca gaa gct gag atg			528
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	165	170	175
gag atg tca cct gct gga caa atc tcc gac aat ctt ccg gtg act ctc			576
Glu Met Ser Pro Ala Gly Gln Ile Ser Asp Asn Leu Pro Val Thr Leu			
	180	185	190
cca cta ctt aat tagccacctt aaatcggcgg ttgaaatcaa aatccaaaac			628
Pro Leu Leu Asn			
195			
atatataatt atgaagaaaa aaaaaataag atatgtaatt attccgctga taagggcgag			688
cgtttgtata tcttaatact ctctcttttg ccaagagact ttgtgtgtga tacttaagta			748
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<212> PRT			

<213> Arabidopsis thaliana

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Arg Gln Val Thr Phe Ser Lys Arg Arg Asn Gly Leu Ile Glu Lys Ala
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Arg Gln Leu Ser Val Leu Cys Asp Ala Ser Val Ala Leu Leu Val Val
35 40 45

Ser Ala Ser Gly Lys Leu Tyr Ser Phe Ser Ser Gly Asp Asn Leu Val
50 55 60

Lys Ile Leu Asp Arg Tyr Gly Lys Gln His Ala Asp Asp Leu Lys Ala
65 70 75 80

Leu Asp His Gln Ser Lys Ala Leu Asn Tyr Gly Ser His Tyr Glu Leu
85 90 95

Leu Glu Leu Val Asp Ser Lys Leu Val Gly Ser Asn Val Lys Asn Val
100 105 110

Ser Ile Asp Ala Leu Val Gln Leu Glu Glu His Leu Glu Thr Ala Leu
115 120 125

Ser Val Thr Arg Ala Lys Lys Thr Glu Leu Met Leu Lys Leu Val Glu
130 135 140

Asn Leu Lys Glu Lys Glu Lys Met Leu Lys Glu Glu Asn Gln Val Leu
145 150 155 160

Ala Ser Gln Met Glu Asn Asn His His Val Gly Ala Glu Ala Glu Met
165 170 175

Glu Met Ser Pro Ala Gly Gln Ile Ser Asp Asn Leu Pro Val Thr Leu
180 185 190

Pro Leu Leu Asn
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<222> (1)..(519)

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cga caa gtc act ttc tcc aaa cga cgc aat ggt ctc atc gac aaa gct	96
Arg Gln Val Thr Phe Ser Lys Arg Arg Asn Gly Leu Ile Asp Lys Ala	
20 25 30	
cga caa ctt tcg att ctc tgt gaa tcc tcc gtc gct gtt gtc gtc gta	144
Arg Gln Leu Ser Ile Leu Cys Glu Ser Ser Val Ala Val Val Val	
35 40 45	
tct gcc tcc gga aaa ctc tat gac tct tcc tcc ggt gac gac att tcc	192
Ser Ala Ser Gly Lys Leu Tyr Asp Ser Ser Ser Gly Asp Asp Ile Ser	
50 55 60	
aag atc att gat cgt tat gaa ata caa cat gct gat gaa ctt aga gcc	240
Lys Ile Ile Asp Arg Tyr Glu Ile Gln His Ala Asp Glu Leu Arg Ala	
65 70 75 80	
tta gat ctt gaa gaa aaa att cag aat tat ctt cca cac aag gag tta	288
Leu Asp Leu Glu Glu Lys Ile Gln Asn Tyr Leu Pro His Lys Glu Leu	
85 90 95	
cta gaa aca gtc caa agc aag ctt gaa gaa cca aat gtc gat aat gta	336
Leu Glu Thr Val Gln Ser Lys Leu Glu Glu Pro Asn Val Asp Asn Val	
100 105 110	
agt gta gat tct cta att tct ctg gag gaa caa ctt gag act gct ctg	384
Ser Val Asp Ser Leu Ile Ser Leu Glu Glu Gln Leu Glu Thr Ala Leu	
115 120 125	
tcc gta agt aga gct agg aag gca gaa ctg atg atg gag tat atc gag	432
Ser Val Ser Arg Ala Arg Lys Ala Glu Leu Met Met Glu Tyr Ile Glu	
130 135 140	
tcc ctt aaa gaa aag gag aaa ttg ctg aga gaa gag aac cag gtt ctg	480
Ser Leu Lys Glu Lys Glu Lys Leu Leu Arg Glu Glu Asn Gln Val Leu	
145 150 155 160	
gct agc cag ctg tca gag aag aaa ggt atg tct cac cga tgaaagatac	529
Ala Ser Gln Leu Ser Glu Lys Lys Gly Met Ser His Arg	

165

170

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 atcaacggct gagttttcac cttaaactca aagcctgatt cataattaag agaataaatt 709
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Arg Gln Val Thr Phe Ser Lys Arg Arg Asn Gly Leu Ile Asp Lys Ala
 20 25 30

Arg Gln Leu Ser Ile Leu Cys Glu Ser Ser Val Ala Val Val Val Val
 35 40 45

Ser Ala Ser Gly Lys Leu Tyr Asp Ser Ser Ser Gly Asp Asp Ile Ser
 50 55 60

Lys Ile Ile Asp Arg Tyr Glu Ile Gln His Ala Asp Glu Leu Arg Ala
 65 70 75 80

Leu Asp Leu Glu Glu Lys Ile Gln Asn Tyr Leu Pro His Lys Glu Leu
 85 90 95

Leu Glu Thr Val Gln Ser Lys Leu Glu Glu Pro Asn Val Asp Asn Val
 100 105 110

Ser Val Asp Ser Leu Ile Ser Leu Glu Glu Gln Leu Glu Thr Ala Leu
 115 120 125

Ser Val Ser Arg Ala Arg Lys Ala Glu Leu Met Met Glu Tyr Ile Glu

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cga caa gtc act ttc tcc aaa cga cgc aat ggt ctc atc gag aaa gct	96
Arg Gln Val Thr Phe Ser Lys Arg Arg Asn Gly Leu Ile Glu Lys Ala	
20 25 30	
cga caa ctt tca att ctc tgt gaa tct tcc atc gct gtt ctc gtc gtc	144
Arg Gln Leu Ser Ile Leu Cys Glu Ser Ser Ile Ala Val Leu Val Val	
35 40 45	
tcc ggc tcc gga aaa ctc tac aag tct gcc tcc ggt gac aac atg tca	192
Ser Gly Ser Gly Lys Leu Tyr Lys Ser Ala Ser Gly Asp Asn Met Ser	
50 55 60	
aag atc att gat cgt tac gaa ata cat cat gct gat gaa ctt gaa gcc	240
Lys Ile Ile Asp Arg Tyr Glu Ile His His Ala Asp Glu Leu Glu Ala	
65 70 75 80	
tta gat ctt gca gaa aaa act cgg aat tat ctg cca ctc aaa gag tta	288
Leu Asp Leu Ala Glu Lys Thr Arg Asn Tyr Leu Pro Leu Lys Glu Leu	
85 90 95	
cta gaa ata gtc caa agc aag ctt gaa gaa tca aat gtc gat aat gca	336
Leu Glu Ile Val Gln Ser Lys Leu Glu Glu Ser Asn Val Asp Asn Ala	
100 105 110	

agt gtg gat act tta att tct ctg gag gaa cag ctc gag act gct ctg 384
 Ser Val Asp Thr Leu Ile Ser Leu Glu Glu Gln Leu Glu Thr Ala Leu
 115 120 125

tcc gta act aga gct agg aag aca gaa cta atg atg ggg gaa gtg aag 432
 Ser Val Thr Arg Ala Arg Lys Thr Glu Leu Met Met Gly Glu Val Lys
 130 135 140

tcc ctt caa aaa acg gag aac ttg ctg aga gaa gag aac cag act ttg 480
 Ser Leu Gln Lys Thr Glu Asn Leu Leu Arg Glu Glu Asn Gln Thr Leu
 145 150 155 160

gct agc cag gtg aca aaa aca tct ctt gaa gct aat tca tca gtt gat 528
 Ala Ser Gln Val Thr Lys Thr Ser Leu Glu Ala Asn Ser Ser Val Asp
 165 170 175

aca caa taaaaataga aattacactt gcgttaaaca tatatatata aaagttgaag 584
 Thr Gln

gactttgatt gatgtaggc attttttttg tgaaaccccc atatatctta aaatctatga 644

taaaagtcct ttcaaaattc aaatttcttg ttactattta gttgaatgat cagttttaat 704

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Arg Gln Leu Ser Ile Leu Cys Glu Ser Ser Ile Ala Val Leu Val Val
 35 40 45

Ser Gly Ser Gly Lys Leu Tyr Lys Ser Ala Ser Gly Asp Asn Met Ser
 50 55 60

Lys Ile Ile Asp Arg Tyr Glu Ile His His Ala Asp Glu Leu Glu Ala
 65 70 75 80

Leu Asp Leu Ala Glu Lys Thr Arg Asn Tyr Leu Pro Leu Lys Glu Leu
85 90 95

Leu Glu Ile Val Gln Ser Lys Leu Glu Glu Ser Asn Val Asp Asn Ala
100 105 110

Ser Val Asp Thr Leu Ile Ser Leu Glu Glu Gln Leu Glu Thr Ala Leu
115 120 125

Ser Val Thr Arg Ala Arg Lys Thr Glu Leu Met Met Gly Glu Val Lys
130 135 140

Ser Leu Gln Lys Thr Glu Asn Leu Leu Arg Glu Glu Asn Gln Thr Leu
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Thr Gln

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aga caa gtc acc tcc tgc aaa cga cgc aac ggt ctc atc gag aaa gct 96
Arg Gln Val Thr Ser Cys Lys Arg Arg Asn Gly Leu Ile Glu Lys Ala
20 25 30

cgt cag ctt tct gtt ctc tgc gag gca tct gtt ggg ctt ctc gtt gtc 144

Arg	Gln	Leu	Ser	Val	Leu	Cys	Glu	Ala	Ser	Val	Gly	Leu	Leu	Val	Val	
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Ser	Ala	Ser	Asp	Lys	Leu	Tyr	Ser	Phe	Ser	Ser	Gly	Asp	Arg	Leu	Glu	
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aag	atc	ctt	gat	cga	tat	ggg	aaa	aaa	cat	gct	gat	gat	ctc	aat	gcc	240
Lys	Ile	Leu	Asp	Arg	Tyr	Gly	Lys	Lys	His	Ala	Asp	Asp	Leu	Asn	Ala	
		65			70				75						80	
ctg	gat	ctt	cag	tca	aaa	tct	ctg	aac	tat	agt	tca	cac	cat	gag	cta	288
Leu	Asp	Leu	Gln	Ser	Lys	Ser	Leu	Asn	Tyr	Ser	Ser	His	His	Glu	Leu	
				85				90						95		
cta	gaa	ctt	gtg	gaa	agc	aag	ctt	gtg	gaa	tca	att	gat	gat	gta	agc	336
Leu	Glu	Leu	Val	Glu	Ser	Lys	Leu	Val	Glu	Ser	Ile	Asp	Asp	Val	Ser	
			100					105						110		
gtg	gat	tcc	ctc	gtt	gag	cta	gaa	gat	cac	ctt	gag	act	gcc	ctc	tct	384
Val	Asp	Ser	Leu	Val	Glu	Leu	Glu	Asp	His	Leu	Glu	Thr	Ala	Leu	Ser	
		115					120					125				
gta	act	aga	gct	cgg	aag	gca	gaa	cta	atg	tta	aag	ctt	gtt	gaa	agt	432
Val	Thr	Arg	Ala	Arg	Lys	Ala	Glu	Leu	Met	Leu	Lys	Leu	Val	Glu	Ser	
		130				135					140					
ctc	aaa	gaa	aag	gag	aat	ctg	ctg	aaa	gaa	gag	aac	cag	gtt	ttg	gct	480
Leu	Lys	Glu	Lys	Glu	Asn	Leu	Leu	Lys	Glu	Glu	Asn	Gln	Val	Leu	Ala	
		145			150					155				160		
agt	cag	att	gag	gag	aaa	aat	ctt	gag	gga	gcc	gaa	gct	gat	aat	ata	528
Ser	Gln	Ile	Glu	Glu	Lys	Asn	Leu	Glu	Gly	Ala	Glu	Ala	Asp	Asn	Ile	
				165					170					175		
gag	atg	tca	tct	gga	caa	atc	tcc	gac	atc	aat	ctt	cct	gta	act	ctc	576
Glu	Met	Ser	Ser	Gly	Gln	Ile	Ser	Asp	Ile	Asn	Leu	Pro	Val	Thr	Leu	
			180					185					190			
ccg	ctg	ctt	aat	taaccac	ctt	tactcggcgg	ttaatcaaaa	taagaaacat								628
Pro	Leu	Leu	Asn													
			195													
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cggcggttaa	tcgaa	attaa	aaacat	ataa	ttaacaaata	acctatgtca	gtttaacccc									748
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863

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<213> Brassica rapa

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Arg Gln Leu Ser Val Leu Cys Glu Ala Ser Val Gly Leu Leu Val Val
35 40 45

Ser Ala Ser Asp Lys Leu Tyr Ser Phe Ser Ser Gly Asp Arg Leu Glu
50 55 60

Lys Ile Leu Asp Arg Tyr Gly Lys Lys His Ala Asp Asp Leu Asn Ala
65 70 75 80

Leu Asp Leu Gln Ser Lys Ser Leu Asn Tyr Ser Ser His His Glu Leu
85 90 95

Leu Glu Leu Val Glu Ser Lys Leu Val Glu Ser Ile Asp Asp Val Ser
100 105 110

Val Asp Ser Leu Val Glu Leu Glu Asp His Leu Glu Thr Ala Leu Ser
115 120 125

Val Thr Arg Ala Arg Lys Ala Glu Leu Met Leu Lys Leu Val Glu Ser
130 135 140

Leu Lys Glu Lys Glu Asn Leu Leu Lys Glu Glu Asn Gln Val Leu Ala
145 150 155 160

Ser Gln Ile Glu Glu Lys Asn Leu Glu Gly Ala Glu Ala Asp Asn Ile
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180 185 190

Pro Leu Leu Asn
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 cga caa gtc acc ttc tcc aaa cga cgc agc ggt ctc atc gag aaa gct 96
 Arg Gln Val Thr Phe Ser Lys Arg Arg Ser Gly Leu Ile Glu Lys Ala
 20 25 30
 cgt cag ctt tct gtt ctc tgc gag gca tct gtt ggg ctt ctc gtt gtc 144
 Arg Gln Leu Ser Val Leu Cys Glu Ala Ser Val Gly Leu Leu Val Val
 35 40 45
 tcc gcc tcc gac aaa ctc tac agc ttc tcc tcc ggg gat aga ctg gag 192
 Ser Ala Ser Asp Lys Leu Tyr Ser Phe Ser Ser Gly Asp Arg Leu Glu
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 Lys Ile Leu Asp Arg Tyr Gly Lys Lys His Ala Asp Asp Leu Asn Ala
 65 70 75 80
 ctg gat ctt cag tca aaa tct ctg aac tat agt tca cac cat gag cta 288
 Leu Asp Leu Gln Ser Lys Ser Leu Asn Tyr Ser Ser His His Glu Leu
 85 90 95
 cta gaa ctt gtg gaa agc aag ctt gtg gaa tca att gat gat gta agc 336
 Leu Glu Leu Val Glu Ser Lys Leu Val Glu Ser Ile Asp Asp Val Ser
 100 105 110
 gtg gat tcc ctc gtt gag cta gaa gat cac ctt gag act gcc ctc tct 384
 Val Asp Ser Leu Val Glu Leu Glu Asp His Leu Glu Thr Ala Leu Ser
 115 120 125
 gta act aga gct cgg aag gca gaa cta atg tta aag ctt gtt gaa agt 432
 Val Thr Arg Ala Arg Lys Ala Glu Leu Met Leu Lys Leu Val Glu Ser
 130 135 140

ctc aaa gaa aag gag aat ctg ctg aaa gaa gag aac cag gtt ttg gct 480
 Leu Lys Glu Lys Glu Asn Leu Leu Lys Glu Glu Asn Gln Val Leu Ala
 145 150 155 160

agt cag att gag aag aaa aat ctt gag gga gcc gaa gct gat aat ata 528
 Ser Gln Ile Glu Lys Lys Asn Leu Glu Gly Ala Glu Ala Asp Asn Ile
 165 170 175

gag atg tca tct gga caa atc tcc gac atc aat ctt cct gta act ctc 576
 Glu Met Ser Ser Gly Gln Ile Ser Asp Ile Asn Leu Pro Val Thr Leu
 180 185 190

ccg ctg ctt aat taaccacctt tactcggcgg ttaatcaaaa taagaaacat 628
 Pro Leu Leu Asn
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ataatctaaa gataacctat gtaggtttta cttttcgag ctttaattaac cacctttact 688

cggcggttaa tcgaaattaa aaacatataa ttaacaaata acctatgtca gtttaacccc 748

ctgataaaga tgcacgttgt acatcttagt tctctctctg gctgaggggc tgtgtaataa 808

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<213> Brassica rapa

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Arg Gln Val Thr Phe Ser Lys Arg Arg Ser Gly Leu Ile Glu Lys Ala
 20 25 30

Arg Gln Leu Ser Val Leu Cys Glu Ala Ser Val Gly Leu Leu Val Val
 35 40 45

Ser Ala Ser Asp Lys Leu Tyr Ser Phe Ser Ser Gly Asp Arg Leu Glu
 50 55 60

Lys Ile Leu Asp Arg Tyr Gly Lys Lys His Ala Asp Asp Leu Asn Ala
 65 70 75 80

Leu Asp Leu Gln Ser Lys Ser Leu Asn Tyr Ser Ser His His Glu Leu

	85		90		95
Leu Glu Leu Val Glu Ser Lys Leu Val Glu Ser Ile Asp Asp Val Ser					
	100		105		110
Val Asp Ser Leu Val Glu Leu Glu Asp His Leu Glu Thr Ala Leu Ser					
	115		120		125
Val Thr Arg Ala Arg Lys Ala Glu Leu Met Leu Lys Leu Val Glu Ser					
	130		135		140
Leu Lys Glu Lys Glu Asn Leu Leu Lys Glu Glu Asn Gln Val Leu Ala					
	145		150		155
Ser Gln Ile Glu Lys Lys Asn Leu Glu Gly Ala Glu Ala Asp Asn Ile					
	165		170		175
Glu Met Ser Ser Gly Gln Ile Ser Asp Ile Asn Leu Pro Val Thr Leu					
	180		185		190
Pro Leu Leu Asn					
	195				